Evaluation of Elk Numbers and Distribution on Private Lands in the East Kootenay

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INTRODUCTION

The East Kootenay region of British Columbia supports one of the greatest diversities and highest densities of large wild mammals in North America. The same area supports a cattle ranching industry. Wildlife and cattle are both dependent on the finite land base, and consequently, competition between these resource users has existed for many years. One of the most contentious issues is the use of private land by wild ungulates which can cause damage to crops, fences and stored feed.

In an attempt to quantify the damage inflicted by native ungulates on private lands and to invite suggestions from ranchers on ways of reducing the problem, Demarchi and Bedford (1979) delivered 431 questionnaires to rural residents, which included all ranchers in the East Kootenay, and received 188 replies. Their analysis showed that 50% of respondents experienced damage from deer or elk and that elk accounted for approximately 75% of the estimated costs of damage. Immediately after this survey the Ministry of Environment instituted special early season, low elevation, limited entry hunts (LEH) intended to reduce the number of elk using agricultural lands. The numbers of LEH authorizations issued were equivalent to the estimated numbers of elk present in each area in summer (Demarchi 1982). Beginning in 1981, the Ministry also issued kill permits to needy individuals to provide sustenance and to control damage caused by elk.

In 1985, the Ministry of Environment hired a consultant to conduct an independent study of the rancher elk conflict and to provide recommendations for future management. Based on personal interviews with 13 ranchers who were experiencing wildlife problems and 3 days of field investigation, Bowden (1985) concluded that wildlife use of private lands was a significant and growing problem in the East Kootenay. In the absence of any numerical assessment of the subject, he also concluded that management programs instituted to control wildlife depredation had not been effective.

Non-migratory elk (NME), believed to be resident in the Rocky Mountain Trench, were identified as a particularly troublesome group because they used ranch properties year round and most wildlife damage reported by ranchers was caused by elk. This sub-group, consisting of an estimated 450-600 animals in 1980, was identified for rigorous control by the Minister of Environment. Control of this group was to be instituted without impacting the main migratory elk herds in the East Kootenay. Although migratory elk did cause problems in winter, when they moved into the valleys, reducing their numbers was deemed impractical because the costs of recreational losses could exceed the costs of the damage being prevented (Bowden 1985). The extent to which NME are a distinct population, separate from the migratory animals, is important to ensure that control programs directed at NME do not impact migratory animals. Data available on the numbers, movements, behaviour and occurrence on private land of NME was clearly not sufficient to define the

characteristics of the problem animals nor to estimate the potential impacts of proposed control programs on the migratory population.

The purposes of this study were to:

1. document the movements and distribution of NME in summer and early fall,
2. estimate their numbers in the main conflict area between Kimberley, Wasa and Jaffray,
3. document their use of private lands in summer and early fall,
4. determine the proportion of cultivated crops in the diet of NME, and
5. interview ranchers in the study area to document the problems they were experiencing with NME.

Public involvement was encouraged by organizing volunteers to count elk in the study area and by interviewing individuals concerned about elk management in the Kootenays. Ranchers, experiencing problems with elk, co-operated by allowing us access to capture and count animals. The effect of shooting elk using private land at night was not evaluated because this type of control was not attempted during the study period.

We thank all ranchers in the study area, especially Anton Rosicky, George Biddlecomb, Jason Mallard and Jesse Mallard, for access to their properties and assistance during the study. The assistance of many volunteers on morning and evening counts is gratefully acknowledged. Thanks also to the Ministry of

Environment staff, especially Wildlife Biologist Anna Wolterson-Strauss and Regional Wildlife Biologist Ray Demarchi, for their advice and assistance.

STUDY AREA

The study area was defined by the Ministry of Environment as the southern Rocky Mountain Trench within 100 km of Cranbrook, B.C. In consultation with the Ministry, we identified five sub-areas bounded by the Kootenay, Bull, Wildhorse and St. Mary's Rivers (Fig. 1). Elk were captured in three of the five sub-areas and radio collared animals moved between all five. The valley bottom was primarily forested within the Interior Douglas Fir Biogeoclimatic Zone and a small portion was occupied by cleared hay fields (Fig. 1). Most fields were irrigated alfalfa while some, especially along the river bottom, were grass. The largest contiguous area of alfalfa fields was the city sewage irrigation development 8 km north-east of Cranbrook, in the Mayook study area. Crown range lands, in the Trench, are managed largely under co-ordinated resource management plans administered by the Ministry of Forests.

METHODS

Elk Capture and Telemetry

Elk were captured in or near alfalfa fields using snares or a net-gun fired from a helicopter. Anectine or rompun was used to immobilize some animals but most were physically restrained

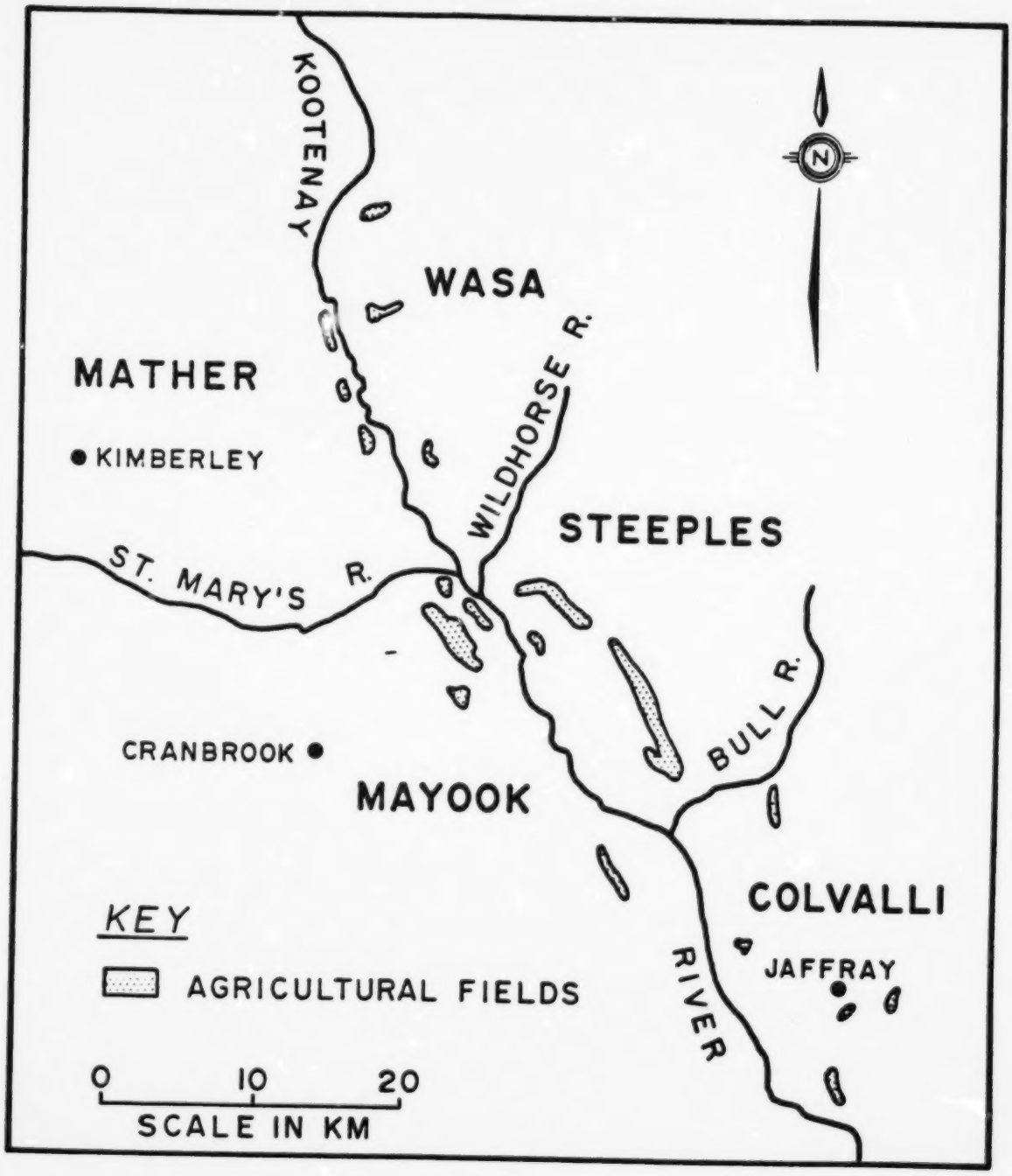

Fig. 1. Five study areas near Cranbrook showing the approximate locations of cultivated fields which were surveyed.

without the use of drugs. Capture was attempted at all sites within the study area where animals were frequently seen.

Radio collared animals were located on the ground by triangulating from three or more known locations. Each animal was also located from fixed-wing aircraft each week. For each location the map co-ordinates (UTM grid), elevation, habitat type and distances from cultivated fields, residences and roads were recorded.

Elk Census on Private Lands

Eleven early-morning flights using fixed-wing aircraft were used to document the numbers of animals using alfalfa and grass fields on 23 properties between Wasa and Jaffray. Forested areas adjacent to fields were checked on each flight since most elk moved into cover shortly after daylight. Both elk and deer were counted on each flight. Flights averaged 70 minutes in length and two observers were present on each flight. Locations of unmarked animals seen during flights were recorded with the same information as radio collared elk.

Morning, evening and night counts, using night vision equipment and spotlights, were made on 22 ranches. Ranchers were contacted to determine if they had seen elk or their sign on each property. Sampling was not completely random. Most effort was concentrated on properties where ranchers indicated that elk were present. Therefore, the sampling was stratified by individual ranches. Elk were classified to age class and sex whenever possible to aid in re-identifying the same group on

future occasions. Classifications were also used to estimate productivity based on the percentage of calves and calf/cow ratios.

Two counts were organized where a total of 58 volunteers were requested to count elk on 18 ranches between Jaffray and Wasa. One count was conducted at dawn and the other at dusk. Ranchers, members of various wildlife clubs and organizations, Ministry of Environment staff and interested citizens all participated.

Food Habits of NME

Pellets groups were collected from areas used by elk. Pellets were categorized based on the location collected. Rumen samples were also collected from dead elk. Rumen samples and composite samples of elk pellets collected in alfalfa fields, riparian areas and forested rangeland were sent for analysis to the Wildlife Habitat Laboratory in Pullman, Washington. Analyses identified the proportion of native versus cultivated foods in the diets of elk found in each habitat type.

Rancher Interviews

We met with owners and operators of each ranch we had censused for elk. Their responses were summarized on a data sheet during each interview. Interview data was used to establish previous levels of elk use, relate numbers of elk to perceived damages, obtain a subjective assessment of changes within the last few years and obtain suggestions to solve

problems where they existed. Information requested included numbers of elk on the property in different seasons, levels and types of damage, hunting effort and success, tolerable numbers of elk, and recommendations to avoid or mitigate damages.

Data Analysis and Interpretation

Analysis of information was mainly descriptive to establish the general characteristics, movement patterns and habitat use of NME. The principle questions addressed included: the range overlap and group fidelity of marked elk, movements outside the valley bottom into "migratory elk" habitats and use of natural versus agricultural lands. Sample sizes, particularly when counts were broken down by location, were too small to permit statistically valid comparisons.

RESULTS

Elk Capture

Twelve elk, including 8 cows, 2 calves and 2 bulls, were captured between August 3 and 22. Six were captured in leg snares and 6 with the net gun at four different locations. Capture was attempted unsuccessfully at 2 other locations using both methods. Darting with immobilizing drugs was attempted at night in alfalfa fields and on forested ranges, but no darts were fired because elk were too wary to approach.

Three elk died during capture, 2 in snares and 1 from net gunning. A fourth animal died 3 days after capture by drowning in a mud hole. It is not known if its death was related to capture. No proven techniques to capture elk in summer were

known prior to this study. The methods used were the best alternatives available, given the short time allowed for capture and the wary behaviour of the elk. Although we made every effort to avoid losing animals, the deaths of some study animals were not predictable and probably unavoidable. Based on our experience and changes made to the techniques, elk could now be captured in summer with a greatly reduced chance of mortality.

Movements of Radio Collared Elk

Of the seven animals collared and tracked, four were definitely resident in the valley and remained below the 3000' contour used to define the low elevation "Z Zone" hunting area (Fig. 2). Movements of females were fairly localized within areas averaging 34 km2. Two individuals did move 30 and 13 km to different areas where they remained for short periods. The widest ranging animal was a young bull (235 km2). Based on the observed short term (August to October) range of movements of the collared sample of elk, it seems likely that all animals within the study area could be expected to move to any other part of the area if followed for a longer period of time.

One cow, caught near Jaffray, moved eastward into the Rocky Mountains within 3 days of capture. She moved rapidly 22 km up the Bull River and remained in that area until the end of the study. We suspect that this obviously migratory animal moved into the valley for a short period, probably to use the mineral lick known locally as Frenchman's slough, where she was captured. The variety of bulls, which could be identified by

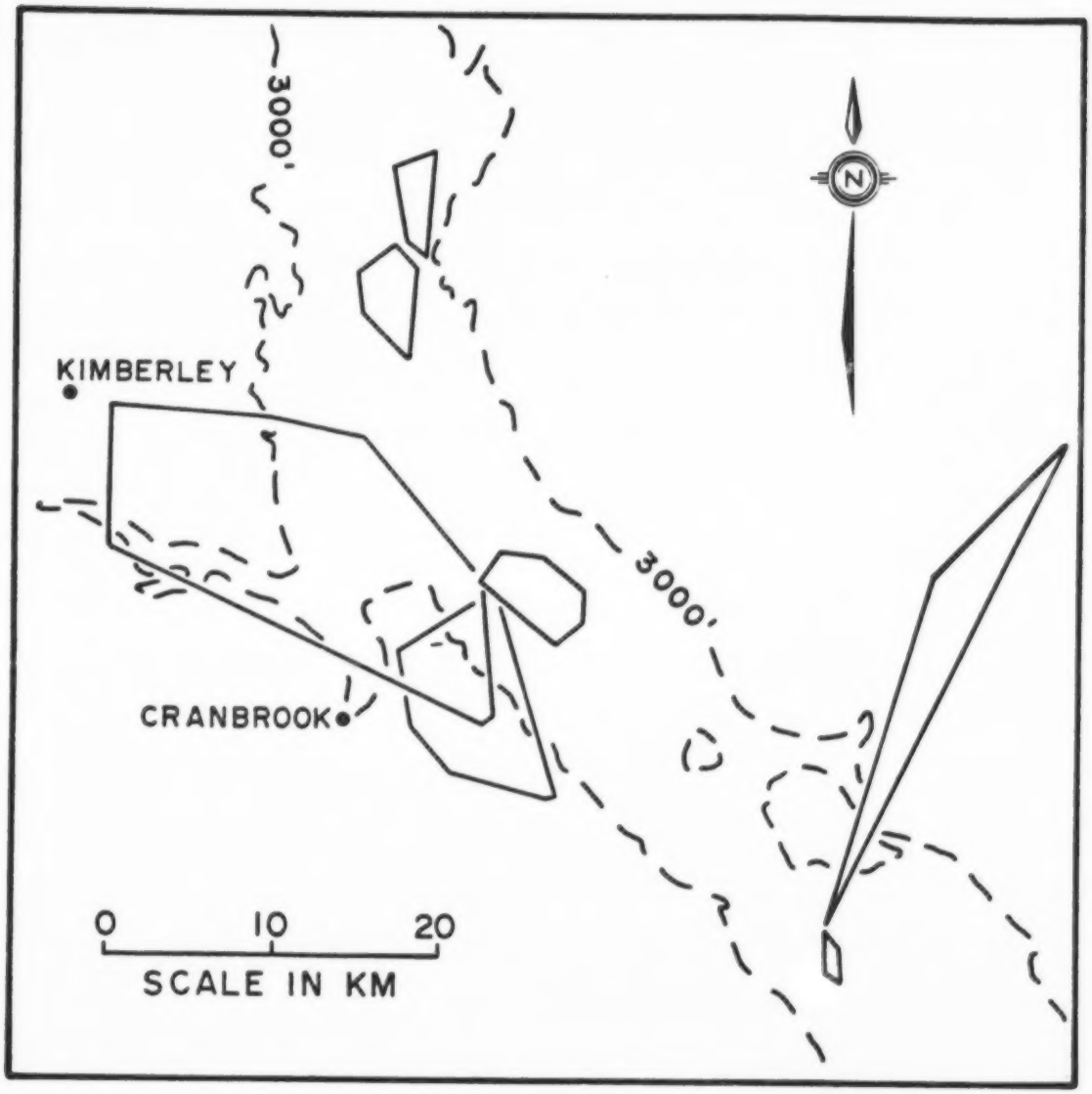

Fig. 2. August to October ranges of seven elk collared in the Rocky Mountain Trench showing movements within areas bounded by the 3000' countour.

antler characteristics, and the large variation in group sizes observed at this site (1-21 between Jul 14 and Aug 25, N=54), also suggest that animals from many distant locations may visit the site infrequently to obtain minerals. Of all the animals seen at this site, 75% were observed licking mud at the edge of a pond. Many migratory animals may move down for short periods, then return to the mountains. Their occurrence in the valley may be related to use of especially attractive or unique locations.

Another cow, captured at the same lick, appeared to be resident based on three days tracking prior to her death. She was observed the day after capture feeding with two other elk in a recently logged area .5 km west of the capture site. The abundance of tracks and pellet groups indicated that elk had been using the area intensively, probably because of the abundance of lush clover available. A larger sample of animals would have to be captured at this lick to determine the actual proportion which are migratory.

Classifications of elk groups, most seen in fields, showed that group structure and size varied considerably at each location over short periods. Radio locations showed that elk were frequently alone on native ranges (Table 1) and probably only joined groups when they moved into alfalfa fields to feed. Although elk usually left the fields as a "herd", this association was probably of short duration. The elk in the valley could best be described as one population of continuously intermingling individuals which formed short term associations

(herds) at some sites which attracted many individuals at the same time.

Radio collared elk, which remained in the valley, were most often located in natural habitats (Table 2). Mature timber was the most frequently used habitat component followed closely by riparian areas. Actual elk use of fields was probably underestimated by the telemetry data because most radio locations were obtained during the day and elk used fields at night. To correct for this bias, the frequency that radio collared animals were found in or less than .3 km from ranchers' fields was used to estimate the level of use of private lands by NME (Table 3). Although collared animals may have been temporarily discouraged from using alfalfa fields following capture, their use of fields remained consistent in September and October when their fear of capture would, presumably, have declined. We, therefore, assumed that observed movements of collared elk represented normal elk behaviour.

NME Use of Private Lands

Elk counts on early morning transect flights varied from 6 to 51 with an average of 34 from July 31 to September 8. Some of these animals were seen on crown range (24%) or the city sewage irrigation fields (37%) while the remainder (38%) were seen on or near private fields. Until mid-August, a large group totalling 49 animals was consistently seen on the city sewage irrigation fields in the Mayook study area. This group was not

Table 1. The number of times radio collared elk were observed in groups or alone on native ranges in the East Kootenay study area.

	Number in group			
	1	2	>2	N
% of radio locations	48	9	43	23

Table 2. Habitats used by radio collared elk in the Rocky Mountain Trench.

	Fields	Immature forest	Mature forest	Riparian	N
% of locations	7.5	4.1	49.6	38.8	121

Table 3. The number of times radio collared elk were observed close to ranchers fields in the East Kootenay study area.

No. locations	% near fields (< .3 km)	% away from fields (> .4 km)
112	14	86

August 17 and 18. Bow hunting, which opened August 20, may also have contributed to the dispersal of this group. No elk were observed or reported at other locations in the Mayook area prior to August 20. Elk counts in the Mather study area were confined to the properties adjacent to the Kootenay River. Initial interviews with ranchers between Cranbrook and Kimberley confirmed that elk were rarely seen in that area in summer. Other areas where elk were frequently seen were Bummers Flats and several private alfalfa fields within 3 km of the Kootenay River between Wolf Creek and Buck Lake.

Night counts showed that few or no elk were present on many alfalfa fields. In fact, during July and August, only three private ranches were found where elk were present frequently enough to permit attempts at capture. Elk were seen or reported in a variety of other locations but use was too inconsistent and irregular to attempt capture. Two blitz counts covering 18 ranches and 33 fields yielded total counts of 7 elk on the evening count and 20 elk on the morning count. These totals were consistent with our transect counts which, excluding the city fields, averaged 21 animals (SD= 17.4, N=11) from July 31 to September 8. It should be noted that elk were very wary and became more nocturnal as hunting season approached. Even with night vision equipment, getting a reliable count in the dark was difficult. It was relatively easy to establish if animals were present because elk were very vocal at night and could be heard when nearby. Numbers of elk increased in regularly censused

fields in late September and October and animals were seen in several locations where none had been seen or reported earlier. We could not determine if this represented a redistribution of the NME or an early influx of migratory animals. We assumed these higher counts were mainly due to increased use of alfalfa fields by NME and included them when deriving the population estimates given in Table 4.

NME Population Estimate

Information from transect flights was combined with ground counts and data from other flights to estimate the number of elk in each area. Assuming that maximum numbers seen were close to the actual number present and using judgement to eliminate duplicate counts between ranches, we estimated the number of elk using each ranch and the total population in the each sub-area (Table 4). The estimated numbers using fields in each sub-area were inflated by the presence of migratory elk, which formed an unknown part of the count, and by the known movement of animals between sub-areas. The total of 234 animals therefore, represents a generous estimate of the number of NME present between Wasa, Kimberley and Jaffray during the period of the study. However, other elk may have been present in the valley which did not use ranchers' fields and therefore, would not be included in our estimate.

Table 4. Maximum counts including duplicates and estimated numbers of elk in five sub-areas within the East Kootenay study area.

Study area	Time period	Sum of maximum counts /site	Estimated population
Wasa	Jul 24 - Oct 31	108	64
Mather	Aug 22 - Oct 25	61	36
Steeples	Jul 26 - Oct 31	102	56
Mayook	Jul 26 - Oct 31	157	50
Colvalli	Jul 14 - Sep 6	37	28
	TOTALS	465	234

A second estimate of NME numbers was calculated based on the observed use of fields by collared elk. Collared elk were located in or close to fields 14% of the time (Table 3), indicating that fields received about this proportion of use. If all elk used fields as frequently, the number observed in each sub-area should have equalled 14% of the NME population. The correspondence between observed numbers in fields and predicted numbers, calculated as 14% of the estimated population, was relatively high in the three intensively surveyed study areas (Table 5). Total numbers estimated in these three areas using this method would be 177 compared to 148 estimated in Table 4.

Table 5. Mean numbers of elk observed in fields relative to estimated populations in three sub-areas of the East Kootenay study area.

Sub-area	Mean no. seen per ranch	N	14 % of estimated population
	4.1	46	
	0.4	24	
	0.9	26	
	4.8	36	
	3.0	29	
TOTAL WASA	13.2	161	9.0
	0.6	24	
	5.0	35	
	0.6	24	
	0.1	24	
	0.4	16	
	0.3	17	
	0.0	17	
	0.0	21	
TOTAL STEEPLES	7.0	178	7.8
	4.1	76	
	0.5	15	
	0.0	14	
TOTAL COLVALLI	4.6	105	3.9
GRAND TOTALS	24.8	444	20.7

Based on classifications of 122 groups, NME had a high proportion of calves (26%) and good calf/cow ratios (55.5/100). Productivity of this group may be high because of their seasonal access to high protein foods, favourable weather conditions and limited requirements to make long distance migrations.

Table 6. Food habits of NME in the East Kootenay study area.

Habitat type	Sample type	N	% Native foods	% Cultivated foods	
				Alfalfa	Grains
Forested	pellets	17	90.8	1.5	7.7
Riparian	pellets	16	80.1	11.6	8.3
Cultivated	pellets	20	81.5	12.5	6.0
Cultivated	rumens	4	68.2	19.0	12.8
	Means		80.2	11.2	8.7

Food Habits of NME

Analyses of pellets and rumens collected showed that 80% of the foods consumed by NME were obtained on native ranges (Table 6). The similarity in composition between samples collected in different areas suggests that most elk found in the valley made some use of agricultural crops and moved freely between different habitat types to feed. Alfalfa and other cultivated crops are believed to be more digestible than native forage. The higher proportion of alfalfa found in the rumen samples may indicate that pellet analyses underestimated the proportion of

cultivated foods in the diet because cultivated foods are more completely digested. Further analyses of individual, not composite samples should be undertaken to confirm this relation.

Table 7. Rancher estimates of numbers of elk and damage in comparison with counts of elk made during this study.

Severity of damage	Largest group seen	Rancher estimate	Mean numbers of elk Transects 11 counts	Other mean	counts N
High	46	30	0	15.3	3
High	23	20	1.2	5.1	37
Moderate	12	40		3.6	5
Light	40	15	7.3	5.5	32
Light	20	15	0	4.4	18
Light	17	20	0	5.8	4
Light	5	10	0	1.0	5
Light	0	6	0	0	6
Light	0	3	0	0	10
Light	8	8	0	0.8	13
None	30	8	1.6	6.1	28
None	21	8	0	4.8	65
None	6	10	0.1	1.0	7
None	3	8	0.4	0.9	7
None	0	0	0	1.1	13
None	5	0	0	0.9	13
None	2	0	0	0.2	13

Note: Some interviewed ranchers were excluded because we had no comparative counts.

Interviews with Ranchers

Interviews with 21 ranchers provided comparative information on numbers of elk in previous years and perceived amounts of damage caused by elk. We made no attempt to assess the damage done by elk to standing crops although we did observe the signs of their presence including beds, trails, uprooted plants and trampling. The number of animals estimated to be present by ranchers were higher than shown by our counts (Table 7) and were

approximately equivalent to the maximum numbers that we observed rather than the average. Small sample sizes on some properties outside of our intensively studied sub-areas were not adequate to document actual use by elk.

The estimates of severity of damage were not related to the number of animals present. Some ranchers who reported little or no damage had higher numbers of elk than others who reported severe or moderate damage. Most ranchers indicated that they could tolerate low numbers of elk (4-20) on their property but all stated that higher numbers had caused problems in the past. Fence damage and grazing or trampling crops, mainly alfalfa, were the most common problems. None had problems with elk using stored crops, since all had exclusion fences around storage areas. Almost all ranchers allowed hunting and indicated that a few animals were killed each year on their property. Harassment by hunting was believed to discourage use of fields for short periods and to alter behaviour by making elk more nocturnal. Some ranchers believed that hunting had temporarily reduced the number of animals using their property (38%), and more believed that there were fewer elk in 1986 than in previous years (50%). Few believed that elk numbers had increased (22%).

Recommendations to prevent problems included continued or increased hunting pressure to keep elk numbers down (55%) and enhancement of natural habitats to provide alternative quality habitats for elk away from ranchers fields (30%). Ranchers who did have significant wildlife problems (15%), favoured some type

of compensation or assistance from the government. Although few ranchers suffered significant damage in summer or early fall, most (80%) stated that higher numbers of elk, present in spring, caused damage to young crops, particularly alfalfa.

Ranchers resented the implication that claims for compensation were attempts to obtain a government handout and for that reason some may have been reluctant to even recommend compensation. Most ranchers clearly wanted some elk on their property primarily for personal use and enjoyment, provided they did not cause major problems or severe economic losses. Ranchers stated their concern and demonstrated reasonable attitudes toward wildlife problems to the study team. No indications were given that ranchers felt victimized by, nor even in direct conflict with, groups promoting wildlife and hunting in the valley. Ranchers were very concerned with the ramifications of agency removal of elk. This combined with opposition from other user groups, resulted in the majority of ranchers (6/10) refusing access to Conservation Officer staff for the purpose of shooting elk at night on their property.

Ranchers also made some important observations which should be considered since they affect the interpretation and validity of the information presented here. First, our activities of trapping and spotlighting elk during the study period undoubtedly influenced the counts of elk on some properties where we were most active at night. Second, though the spring of 1986 was not unusually wet (Table 8), unseasonable periodic

rains in July were reported to have kept the forage on crown ranges far more abundant and succulent than normal. Some ranchers felt that fewer elk used their fields because natural

Table 8. Precipitation at Cranbrook airport in 1986 compared to previous years.

Years	mm precipitation							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Total
1975-85	24.9	23.3	17.8	27.4	42.2	53.2	34.7	223.5
1986	24.9	47.9	10.8	34.7	45.3	43.8	32.4	239.8

habitats were in better condition than previous years. On the other hand, we obtained more counts in areas where elk were known to be present because we were actively trying to capture elk. Random or systematic counts on all ranches would certainly have yielded many more zero counts as shown by the transect flights. Answering these concerns will require systematic data collection during a year with normal rainfall when capture activities are not ongoing around private fields.

DISCUSSION

Based on 444 observations on 16 ranches, an average of 1.6 elk were seen on each ranch in the three intensively studied sub-areas. Ranches with the highest use all grew alfalfa and were close to the Kootenay River. Although ranchers reported damage from wildlife using their property, it was not considered to be a serious problem in summer by most, primarily because

observed numbers were below the tolerable limits set by each rancher.

These results contradict those of the most recent report on the subject of wildlife damage to private land in the East Kootenay. Although Bowden (1985) considered year round damage, he did state that NME were causing significant damage in summer and that their numbers, estimated at 450-600, had not been reduced by early season low elevation hunts instituted by the Ministry of Environment in 1980. The current estimate of 234 indicates that this group has been substantially reduced in numbers. Half of the ranchers interviewed felt they had fewer NME than in previous years. Contrary to suggestions by Bowden (1985) that management of low elevation elk was intentionally ineffective to promote more hunting opportunities in the valley, increased hunting has brought elk numbers down to a level tolerable to most ranchers.

Some ranches were identified where elk continue to use private fields in disproportionately high numbers in summer. Responses of ranchers indicated that high numbers were not always associated with significant damage. The behaviour and activities of elk in fields and the amount of time they remain probably influence the level of damage. Although most feeding was done on natural rangelands, food habit data showed that NME did obtain 20% of their diet from agricultural fields. More information on the activities of elk at high damage sites would be useful to identify damaging behaviours and develop preventative measures. An essential element of further work

would be to develop methods to record and quantify wildlife damage to agricultural properties. Opportunities do exist to measure crop production on ranches with and without elk problems. It was apparent that different management practices and/or basic differences in soil quality could confound comparisons between ranches unless planned with great care. Another method would be to compare alfalfa growth inside and outside wildlife exclosures (Palmer et al. 1982). We feel it is likely that a very large number of treatment comparisons would be required with suitable controls to detect significant differences.

The current information suggests that migratory and non-migratory elk populations are not discreet. Three of seven animals captured in summer were definitely or potentially migratory. In addition, it is not known if NME are non-migratory every year or if some different portion of the migratory herd remains in the valley each year. Increased efforts to further reduce the numbers of elk using the valley in summer would likely be unsuccessful because of the potential of large migratory populations to quickly replace their numbers. The continual removal of low elevation elk could significantly impact the migratory population but do little to reduce the annual number of elk using the valley in summer or the amount of elk damage. Further information is needed on the origin of NME and the interchange with the migratory herds before the potential effects of removal programs could be predicted.

Removal of elk on selected properties in summer may also be ineffective in reducing use because only a small proportion of the problem animals are present at one time and different individuals use the same fields on successive nights. Night shooting may eliminate a few individuals but new animals, not previously exposed to night shooting, would replace them on succeeding nights. The difficulties we experienced in capturing elk suggest that removal of a significant number of animals would be very difficult and time consuming.

Efforts should be made to alleviate continuing elk-rancher conflicts at some locations. Bowden (1985) discussed the principle of equity and suggested that, to be fair, ranchers should be compensated for the additional costs they incur as a result of the public desire to maintain large populations of elk. The unfair aspect results because "everyone" benefits from larger numbers of elk while ranchers feel they are the only group which suffers direct additional costs. The most favourable solution, suggested by ranchers, may be to allow ranchers to realize some direct economic gain from having elk on their property. Special hunting privileges are the most obvious and least costly option, but previous proposals have met with opposition from hunting interests (Hatter 1983). The main advantages of making wildlife economically attractive to land owners are elimination of conflicts and potentially, increasing support for and production of wildlife on private lands (Dorrance 1983).

Spring was identified as the time of most severe wildlife damage on private land by 80% of the ranchers interviewed. Reported numbers of animals were 3-5 times greater than those observed in summer and were consistently above the numbers considered tolerable by ranchers. Given the inaccuracy of Bowden's assessment of the summer elk problem, it would be advisable to also undertake a more rigorous assessment of the spring elk problem. Information collected should include the numbers and distribution of elk using the valley in winter, their frequency of use and activities on private lands, timing of migrations, and documentation of the proportion which remain in the valley. Further monitoring of currently collared animals would determine if NME remain non-migratory and allow comparisons between their use of private lands and that of migratory animals. Pitt (1982) suggested that cattle grazing regimes in the East Kootenay may influence the use that elk make of private lands because of differences in resultant range quality. He also recommended studying the relationships between grazing and range quality.

RECOMMENDATIONS

1. Night counts should be repeated in the summer of 1987 to confirm if range conditions or trapping activities influenced the numbers of elk seen on ranches. Trapping activities if required, should be restricted to only a few sites.

2. Spring use of ranches by elk should be documented because ranchers reported most damage during this season.

3. An objective measure of damage caused by elk in problem areas could be made by comparing crop yields on ranches with and without elk problems or by using exclosures within selected ranches.

4. Many elk should be marked in winter to better define the number of migratory elk which are found at low elevations during the summer.

5. If elk are to be removed by night shooting, the effectiveness of this program in reducing elk use and damage should be determined.

6. Management options which allow land owners to realize some benefit from having elk on their property should be explored.

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